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<NOTE>

Termite Fishing by Mahale Chimpanzees: Revisited, Decades Later

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INTRODUCTION

Jane Goodall's discovery in 1960 that wild chimpanzees at Gombe Stream National Park in Tanzania regularly make and use tools to fish for termites was of great importance, as scientists thought at the time that humans were the only species to make and use tools (Goodall 1964). On hearing of Goodall's observation, her mentor, the paleoanthropologist Louis Leakey, famously remarked: "Now we must redefine 'tool', redefine 'man', or accept chimpanzees as 'humans'". But did only Gombe chimpanzees do this?

Since then, evidence of termite fishing has been described in many wild populations of chimpanzees, and is now recognized as one of the most widespread forms of chimpanzee technology (McGrew 1992). The first evidence of termite fishing by the chimpanzees of Bilenge (B group) that inhabit Mahale Mountains National Park in Tanzania dates to 1975. At that time, a local field assistant to the Japanese team of primate researchers by chance discovered recently abandoned plant tools close to a termite mound (Nishida & Uehara 1980). In the following years, more *ad libitum* records followed. These findings suggested that chimpanzees of B group habitually fish for termites, using 16 plant species to manufacture implements made (mostly) from bark, but also from sedges, vines, twigs and leaves (Nishida & Uehara 1980; McGrew & Collins 1985).

Over the last three decades, termite fishing of B group has remained unstudied, as research focus shifted to the habituated neighboring Mimikire (M) group (Nakamura *et al.* 2013).

However, my recent research provides evidence that the Bilenge chimpanzees have continued with their termite fishing tradition, providing yet another example of the long-term maintenance of material culture traditions in our closest living relatives.

METHODS

The unhabituated chimpanzees (*Pan troglodytes schweinfurthii*) of B group live around Bilenge (S 6°2′, E 29°44′; 772–1550 m altitude) in the Mahale Mountains National Park, western Tanzania (Nishida 1968; McGrew & Collins 1985). Bilenge is open grassy woodland, mostly miombo, with narrow strips of vine tangle and valley forests with broad hilltops rising from the coastal plain (Collins & McGrew 1988).

Earlier studies indicated that termite fishing at Bilenge is seasonal, with the most productive months in November and December coinciding with the annual reproductive and dispersal cycles of the termites (McGrew & Collins 1985). My fieldwork, aided by Tanzanian field assistants, thus encompassed three such periods (25 Nov–14 Dec 2014; 20 Oct–8 Nov 2015; 21 Nov–8 Dec 2016). During reconnaissance surveys, we first searched for mounds that had been targeted previously by chim-

Table 1. Plant species used by chimpanzees of B group at Mahale Mountains National Park to source termite fishing tools.

Species	Tools (n)	Individual plants (n)	Parts sourced* (n)
Uvaria angolensis	–	24	33
Uvaria sp. A of FTEA	8	9	10
Monanthotaxis buchananii	2	3	6
Maerua holstii	2	1	1
Garcinia buchananii	1	1	1
Allophylus congolanus	–	3	3
Paullinia pinnata	–	1	1
Mimusops kummel	–	1	1
Grewia stolzii	4	3	4
Saba comorensis	–	1	1
Unidentified	8	–	–
Total	25	47	61

* Individual plants sometimes provided more than one sourced part.

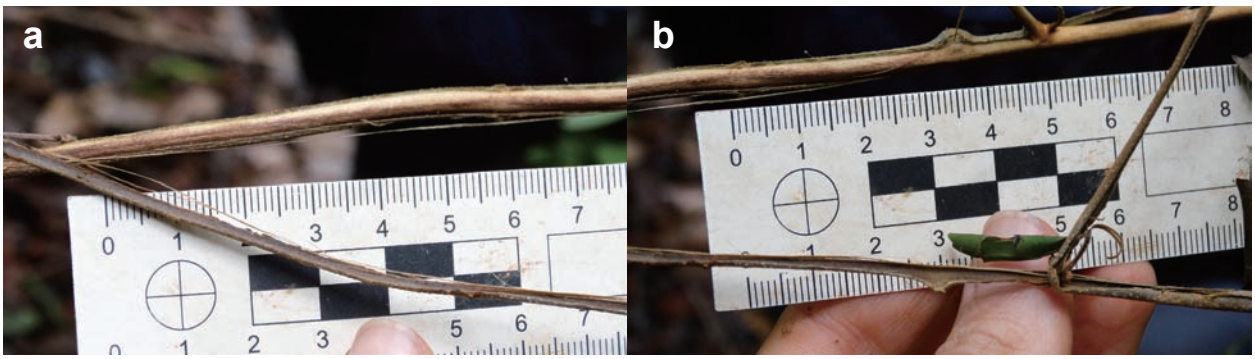

Figure 1. Plant (*Monanthotaxis buchananii*) recently sourced by Mahale chimpanzees for bark. (a–b) Detached bark left on source plant as chimpanzees removed material to manufacture tools. Photo: Alejandra Pascual-Garrido.

panzees, defined by one or more of the following criteria (*cf.*, Pascual-Garrido *et al.* 2012; Almeida-Warren *et al.* 2017): (a) tools, fragments or modified raw materials were present; (b) nearby plants had been sourced for raw material, indicated by, *e.g.*, broken stems or branches or parts removed; (c) abandoned tools could be retrospectively fitted to their sources.

Measurements included tool characteristics such as length, diameter, type of raw material, approximate age (estimated number of days since tool was used), as well as source species of vegetation, location of sourced parts within the plant (*i.e.*, branch, stem) and height and diameter of stem or branch at point of material removal. Termite specimens from targeted mounds fixed in ethanol 80% were later identified by Rudolf Scheffrahn, University of Florida, USA. Samples from source plants were processed at camp with a plant drier for later identification by Frank Mbago, Botany Department, University of Dar es Salaam, Tanzania.

RESULTS

B group members have maintained their termite fishing tradition for more than four decades, as indicated by 2014–2016 records of 25 tools and 47 individual source plants, some of them sourced multiple times, comprising at least 10 species (Table 1). Source plants were found near 14 mounds (Figure 1 a–b), with 5 of these identified as *Macrotermes michaelseni*. One termite mound yielded tools on four dates (1 Dec 2014; 8 Dec 2014; 26 Nov 2016; 28 Nov 2016).

Recovered tools (n = 25) were traced back to 5 plant species, with 47% manufactured from an individual of *Uvaria* sp. A of FTEA, followed by *Grewia stolzii* (23.5%), with 3 tools manufactured from a single plant. *Maerua holstii* and *Monanthotaxis buchananii* were equally represented in the tool assemblage (11.7%), while *Garcinia buchananii* was the least represented (5.8%). All parts detached from plant sources (n = 61) were from bark extractions, with the majority sourced from *Uvaria angolensis* (54.0%) and *Uvaria* sp. A of FTEA (16.3%) (Table 1).

All recovered tools were less than 24 h old, and made exclusively from bark (Figure 2 a–b). The mean length of tools was 38.5 cm (SD = 10.3, n = 25, range: 21.1−65.2), while mean diameter measured at medial point (approximately half-way along the tool) was 3.1 mm (SD = 1.0, n = 25, range: 1.5−5.1). Chimpanzees sourced the raw material (n = 58) mainly from branches (96.5%) and only rarely from stems of plants (3.4%). The vast majority (91.3%) was removed from up to 1.5 m above ground, at a mean height of 92.7 cm (SD = 50.8, n = 58, range: 5−280) (Figure 3). The mean diameter of the stem measured at the point from where the tool material was removed was 8.5 mm (SD = 2.1, n = 58, range: 15.5−5.3).

DISCUSSION

This recent study shows that termite fishing has been maintained by the B group of Mahale chimpanzees for at least 42 years. While the physical characteristics of the

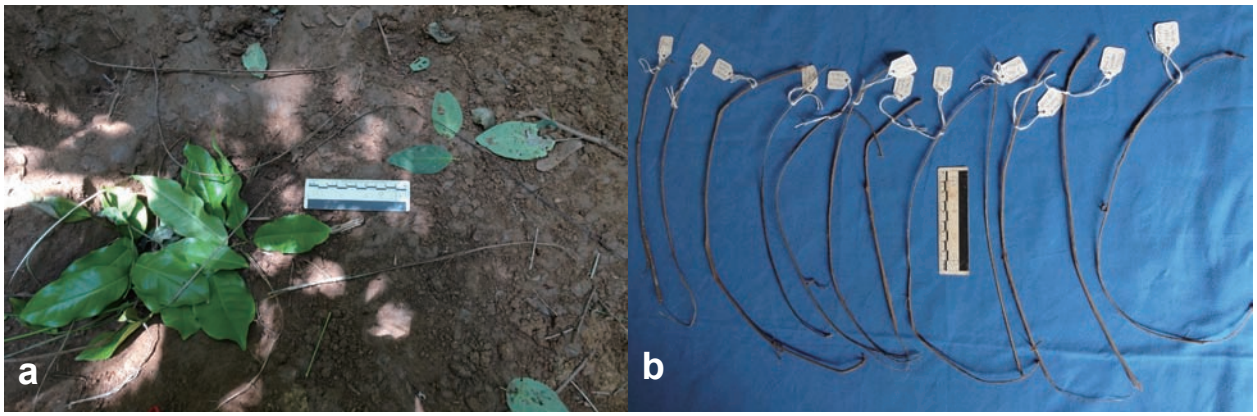

Figure 2. Termite fishing implements abandoned by chimpanzees after foraging at a mound of *Macrotermes michaelseni* (1 Dec 2014). (a) Bark fishing tools in situ, with fresh leaves removed during the manufacturing scattered on ground, (b) Tool assemblage reflecting a fishing event (1 Dec 2014). Photo: Alejandra Pascual-Garrido.

Table 2. Tools, plant source species and targeted prey associated with termite fishing by chimpanzees of B group at Mahale Mountains National Park. Bold = plant species sourced for raw material in more than one study.

Plant Species	Type of material	Tools (n)	Average tool length (cm)	Average tool width (mm)	Termite Species	Time of collection	Source
–	Bark?	97	54.6 (range 21.7–125.6)	–	*M. herus*	Oct–Nov 1978	Uehara 1982
Uvaria angolensis	Bark	133	–	–	*M. herus*	Nov–Dec 1979	Nishida & Uehara 1980
Bauhinia petersiana	Bark						
Grewia platycada	Bark						
Grewia mollis	Bark						
Acalypha sp.	Bark						
Rhynchosia luteola	Vine						
Tylophora sp.	Vine						
Rothmania manganjae	Twig						
Milletia angustidentata	Twig						
Olyra latifolia	Grass, bamboo or sedge						
Hyparrhenia rufa	Grass, bamboo or sedge						
Cyperus diffusus	Grass, bamboo or sedge						
Acalypha chirindica *Artabotrys monteirode* *Bauhinia petersiana* *Carpolobia alba* *Cyphostemma* sp. *Cyperus pseudoleploclaudus*	Bark, sedge, vine, twig, leaf	290	37.7 cm (SD = 14.7)	4.6 mm (SD = 2.0)	*M. herus*	Mainly Nov–Dec 1982	McGrew & Collins 1985
Monanthotaxis buchananii *Uvaria angolensis* *Uvaria* sp. A of FTEA *Saba comorensis* *Maerua holstii* *Garcinia buchananii* *Allophylus congolanus* *Paullinia pinnata* *Mimusops kummel* *Grewia stolzii*	Bark	25	38.5 cm (SD = 10.3)	3.1 mm (SD = 1.0)	*M. michaelseni*	Dec2014/ Nov2016	Current study

tools, such as length and width, are similar with those reported decades ago (McGrew & Collins 1985), some differences emerged in relation to the species of termite prey and the type of material and species used for tool manufacture.

While bark also was predominantly used in the past, other materials such as twig, sedge, vine, grass, bamboo, and leaf also were employed (Nishida & Uehara 1980; McGrew & Collins 1985). That only tools made from bark were recovered in this study may reflect a smaller sample size compared to previous tool assemblages (Nishida & Uehara 1980; McGrew & Collins 1985) (Table 2). Similarly, that only sources with evidence of bark extraction were found might be linked to the high fidelity that "scars" associated to these type of material extractions preserve on the source plant, compared to those associated with the detachment of other material such as twig, vine and grass, which hardly ever preserve (Pascual-Garrido, submitted).

Alternatively, members of B group may have become exclusive bark users in recent decades. If so, then frequency differences in raw materials may reflect changes in their availability (McBeath & McGrew 1982). For example, the cessation of annual burning practice during the last decades might have allowed natural regeneration of woody vegetation near mounds (Collins & McGrew 1988). It also may be that historical variation in tool material preference is responsible (Hobaiter *et al.* 2014).

Chimpanzees show material selectivity for manufacturing certain type of tools, including termite fishing probes (McBeath & McGrew 1982; Sanz & Morgan 2007; Almeida-Warren *et al.* 2017), a skill possibly transmitted across generations through social learning, such as via tool transfers (Sanz *et al.* 2014; Musgrave *et al.* 2016). However, without behavioral evidence of cultural transmission of tool material preference for this study community, this hypothesis remains untested. That measured length and width of the recovered tools seem to have

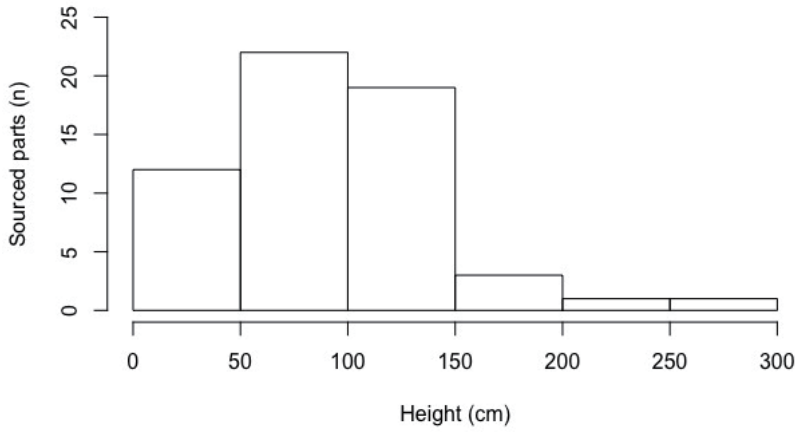

Figure 3. Frequency distribution of heights of sourced plant parts at point of detachment over 50-cm classes.

been largely maintained for decades may be the product of socially learned skills (Sanz *et al.* 2014; Musgrave *et al.* 2016). Alternatively, this could simply be the result of ecological circumstances such as constancy of raw materials (McBeath & McGrew 1982).

From the total of source species recorded in this study, only *Uvaria angolensis* has been used in the past, also as a source of bark (Nishida & Uehara 1980). However, *Artabotrys monteiroae*, *Paulinnia pinnata* and *Grewia* sp. were used by the formerly neighboring, but now extinct, K group to fish for *Pseudoacanthotermes spiniger* (Uehara 1982). Interestingly, *Saba comorensis*, *Grewia* sp, *Monanthotaxis buchananii*, *Uvaria angolensis*, and *Uvaria* sp. A of FTEA are currently sourced for termite fishing bark tools by Issa Valley chimpanzees living 85 km to the east (Almeida-Warren *et al.* 2017), while *Uvaria angolensis*, *Allophylus congolanus* and *Saba comorensis* constitute sources for termite fishing implements at Gombe, 200 km to the north (Pascual-Garrido, submitted).

Different communities of chimpanzees using the same species of plants for tool material could result from their relative abundance. Alternatively, these species might have certain physical characteristics that make them ideal as tool raw material, *i.e.*, optimal flexibility (Teleki 1974). This, in turn, may influence the likelihood that their usage is passed on via social transmission or by individual trial-and-error if the behavior occurs commonly enough. This could result in a possible exchange of members and their skills between communities (O'Malley *et al.* 2012). However, given the fragmented landscape and presence of human population across the region, it is not clear that connectivity exists across ape populations (Piel *et al.* 2013).

Chimpanzees sourced most raw material from branches close to the ground. However, some sources were 2.8 m high, indicating that chimpanzees sometimes climb up to reach desirable sources. Some sources even higher up may have not been visible to researchers. Values for mean height and diameter at which chimpanzees removed raw material at Bilenge are similar to those reported for chimpanzees at Issa Valley (Almeida-Warren *et al.* 2017). This might indicate that chimpanzees focus on where to source raw material, that is, certain heights or branch diameters from where bark easily can be detached (Sanz *et al.* 2004).

Local traditions have been described for animal taxa as diverse as triggerfish, dolphins, whales and capuchin monkeys (for review see Fragaszy & Perry 2003). However, little is known about the exact time when traditions were invented, for how long they are maintained, or when they go extinct (Haslam *et al.* 2016). Thus, as McGrew (1992; p. 196) succinctly commented about the chimpanzees of Gombe: "Termite fishing may just as well have been invented in 1959, the year before Jane Goodall arrived, or a million years ago".

In any case, the current study contributes to the emerging paradigm of "primate archaeology" that aims to add time-depth to tool use behaviors of extant primate populations by identifying when and where tool use traditions are invented, modified or go extinct (Haslam *et al.* 2017).

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<NOTE>

An Old Female Bonobo Carried a Dead Red-Tailed Monkey for over a Month

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INTRODUCTION

Carrying infants is one of the most important maternal tasks determining the survival of dependent infants in non-human primates (Nicolson 1987; Ross 2001). Even after the death of their infants, mothers tend to carry the carcasses for several days, and even up to several months (Hosaka *et al.* 2000; Sugiyama *et al.* 2009; Tokuyama *et al.* 2017). Such prolonged carrying can be considered as "maternal persistency" (Sugiyama *et al.* 2009; Biro *et al.* 2010).

Excluding mothers that carry their infants, non-human primates rarely carry objects for a long period, (Ross 2001; Carvalho *et al.* 2012). However, at Wamba in Democratic Republic of the Congo, we observed that an old female bonobo (*Pan paniscus*) carried the carcass of a red-tailed monkey (*Cercopithecus ascanius*) for over a month. We here report occasional observations of her behaviors and conditions of the monkey carcass, and discuss why she had been persistent with the dead body of another primate.

SITE AND SUBJECT

Observations were made in 2016 at Wamba, Luo Scientific Reserve, Democratic Republic of Congo, which is a long-term field site for the study of wild bonobos (Kano 1992). There are two adjacent groups of bonobos, the eastern group (PE) and the western group (PW), of which all members were fully habituated and identified. We usually followed the PE group from one night's bed sites (around 06:00 h) to the next night's bed sites (around 17:00 h), and occasionally observed the PW group especially during inter-group encounters. The adult female reported in the present study, Chio (estimated to be 45–50 years old), had been identified in the PW group together with her daughter (Chacha: estimated to be 7–8 years old) in September 2012. Since then, Chio had not been observed to have an infant.